**Figure 1**

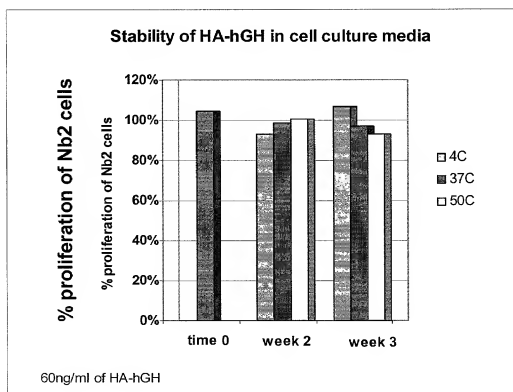


Figure 2

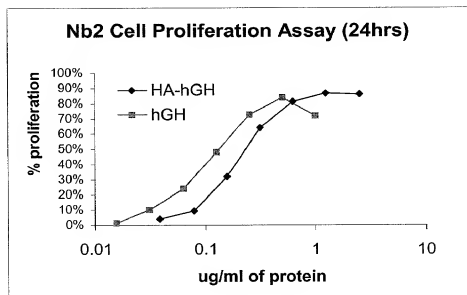


Figure 3A

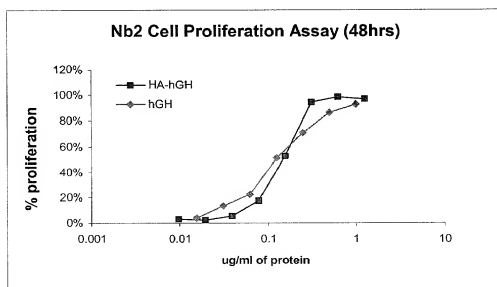


Figure 3B

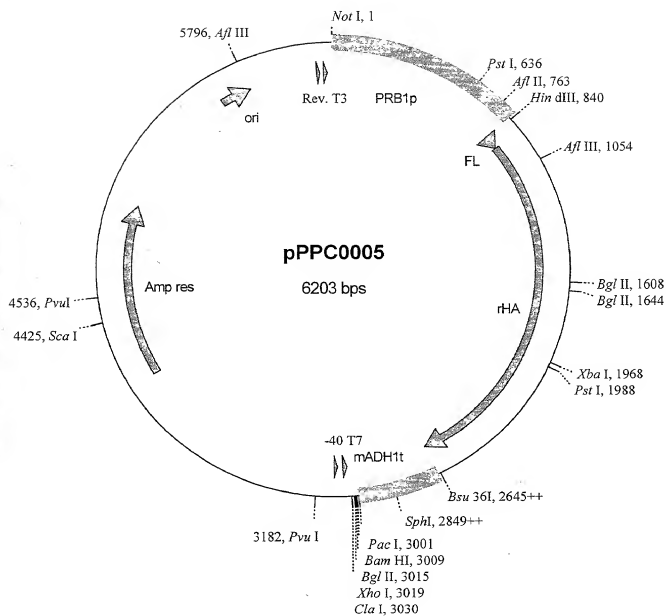


Figure 4

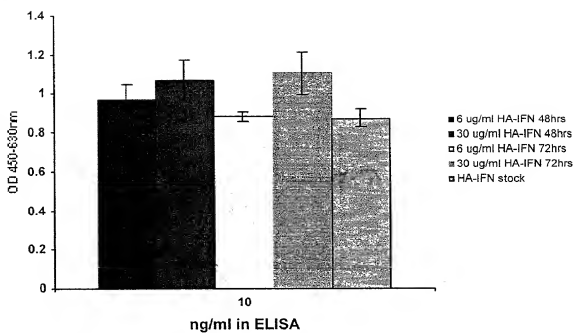


Figure 5

Figure 6

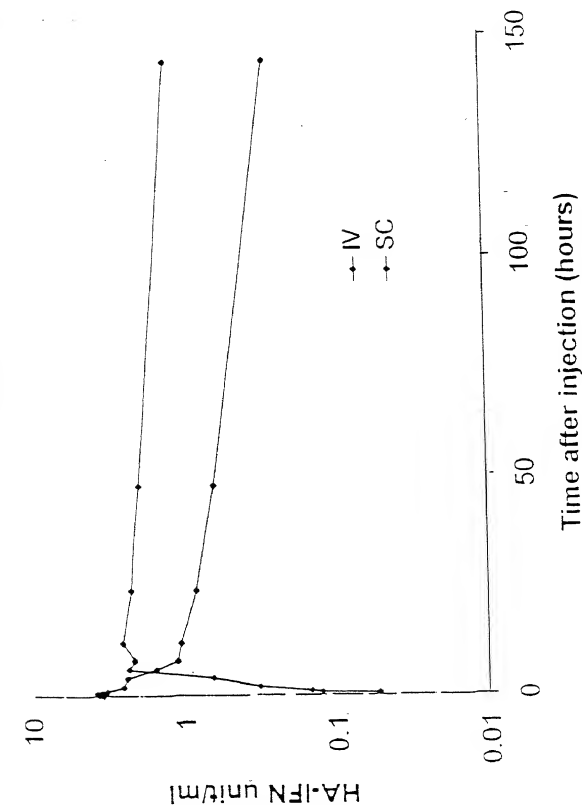
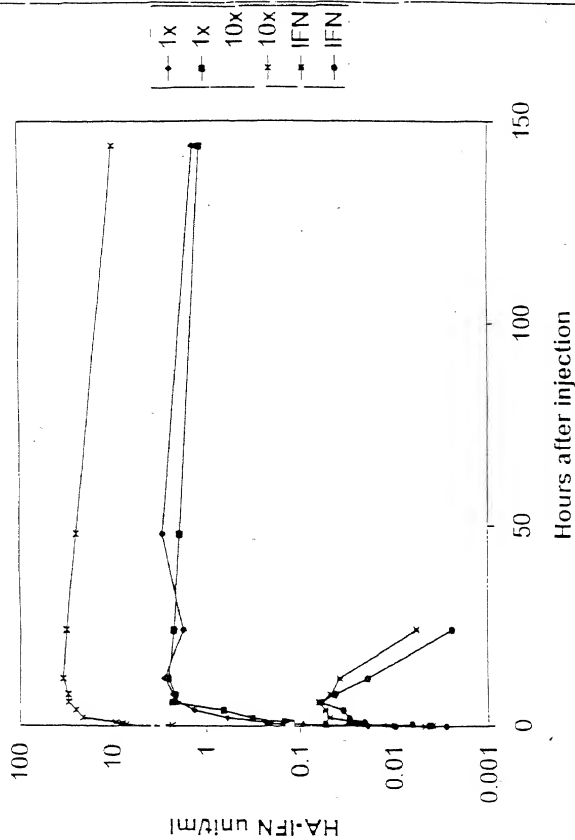


Figure 7



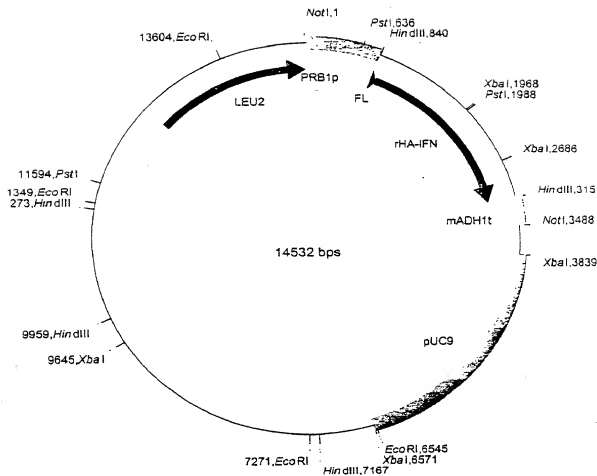


Figure 8. The HA-IFNα expression cassette in pSAC35. The expression cassette comprises

PRB1 promoter, from *S. cerevisiae*.

Fusion leader, first 19 amino acids of the HA leader followed by the last 6 amino acids of the MFα-1 leader.

HA-IFNα coding sequence with a double stop codon (TAATAA)

ADH1 terminator, from *S. cerevisiae*. Modified to remove all the coding sequence normally present in the *Hind* III/*Bam* HI fragment generally used.

Figure 8

Localisation of 'Loops' based on the HA Crvstal Structure
which could be used for Mutation/Insertion

| | | | | | |
|-----|--------------------|---------------------|--------------------|--------------------|--------------------|
| 1 | DAHKSEVAHR | FKDLGEENFK | ALVLIAFAQY | LQCCPFEDHV | KLNVNEVTEFA |
| | HHHHH | HHH | HHH | HHHHHHHHHH | HHHHH |
| | I | | | II | |
| 51 | KTCVADES <u>AE</u> | NCDKSLHTLF | GDKLCTVATL | RETYGEMADC | CAKOE <u>PERNE</u> |
| | HHHHH | HHHHH | HHHHH | HHHH | H |
| 101 | CFLQHKDDNP | NLPRLVRPEV | DVMCTAFHDN | EETFLKKYLY | EIARRHPYFY |
| | HHHH | H | HHHHHHHHH | HHHHHHHHHH | HHHHH |
| | IV | | | | |
| 151 | APELLFFAKR | YKAAFTECCO | AADKAA <u>CLLP</u> | KLDELRLDEGK | ASSAKQRLKC |
| | HHHHHHHHHHH | HHHHHHHHHH | HHHHH | HHHEHHHHHHH | HHHHHHHHHHH |
| | V | | | | |
| 201 | ASLQKFGERA | FKAWAVARLS | QRFPKAEFAE | VSKLVTDLTK | VHTECC <u>HGDL</u> |
| | HHHHH | HH | HHHHHHHHHHH | HH | HHH |
| | VI | | VII | | |
| 251 | LECADDRADL | AKYICEN <u>ODS</u> | ISSKLKECC <u>E</u> | KPLLEKSHCI | AEVENDEMPA |
| | HHHHHHHHHHH | HHHHH | HHHHH | HHHHHHHH | H |
| 301 | DLPSLAADFV | ESKDVCCKNYA | EAKDVFLGMF | LYEYARRHPD | YSVLLRLRLA |
| | HHHH | HHHHHHH | HHHHHHHH | HHHHHH | HHHHHHHHH |
| | VIII | | | | |
| 351 | KTYETTLEKC | CAAAD <u>P</u> HECY | AKVFDEFKPL | VEEPQNLIKQ | NCELFEQLGE |
| | HHHHHHHHHHH | HH | H | HHHHH | HHHHHHHHHHH |
| | IX | | | | |
| 401 | YKFQNALLR | YTKKVPQVST | PTLVEVSRNL | GKVGSKCCK <u>H</u> | PEAKRMPCAE |
| | HHHHHHHHHHH | HHHH | H | HHHHHHHHHHH | HHH |
| | X | | XI | | |
| 451 | DYLSVVLNQL | CVLHEKTP <u>VS</u> | DRVTKCCTES | LVNRRPPCFS | LEVDETYVPK |
| | HHHHHHHHHHH | HHHHH | HHHHHHHHHH | HHHHHHHHH | |
| 501 | EFNAETFTFH | ADICTLSEKE | RQIKKQTALV | ELVKHKPKAT | KEQLKAVMDD |
| | | HHH | HHH | HHHHHMEHHH | HHH |
| | XII | | | | |
| 551 | FAAFVEKCCK | ADDKETCF <u>AE</u> | EGKKLVAA <u>SQ</u> | AALGL | |
| | HHHHHHHHH | HHHH | HHHHHHHHHHH | HH | |
| | Loop | | Loop | | |
| | I | Val54-Asn61 | VII | Glu280-His288 | |
| | II | Thr76-Asp89 | VIII | Ala362-Glu368 | |
| | III | Ala92-Glu100 | IX | Lys439-Pro447 | |
| | IV | Gln170-Ala176 | X | Val462-Lys475 | |
| | V | His247-Glu252 | XI | Thr478-Pro486 | |
| | VI | Glu266-Glu277 | XII | Lys560-Thr566 | |

Figure 9

Examples of Modifications to Loop IV

a. Randomisation of Loop IV.

IV

```

151  APELLFFAKR YKAAFTECCO AADKAACLLP KLDELRDEGK ASSAKQRLKC
      HHHHHHHHHH HHHHHHHHHH          HHHHH HHHHHHHHHHH HHHHHHHHHH
  
```

IV

```

151  APELLFFAKR YKAAFTECCX XXXXXXCLLP KLDELRDEGK ASSAKQRLKC
      HHHHHHHHHH HHHHHHHHHH          HHHHH HHHHHHHHHHH HHHHHHHHHH
  
```

X represents the mutation of the natural amino acid to any other amino acid. One, more or all of the amino acids can be changed in this manner. This figure indicates all the residues have been changed.

b. Insertion (or replacement) of Randomised sequence into Loop IV.

(X)_n
↓
IV

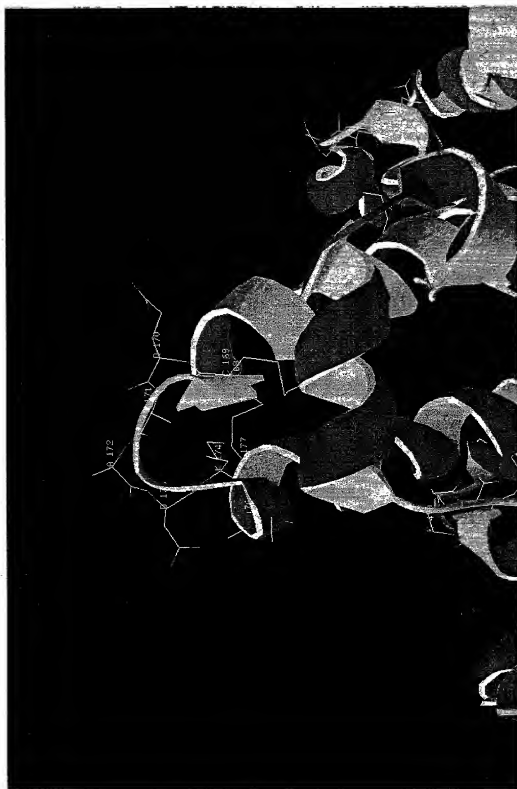
```

151  APELLFFAKR YKAAFTECCO AADKAACLLP KLDELRDEGK ASSAKQRLKC
      HHHHHHHHHH HHHHHHHHHH          HHHHH HHHHHHHHHHH HHHHHHHHHH
  
```

The insertion can be at any point on the loop and the length a length where n would typically be 6, 8, 12, 20 or 25.

Figure 10

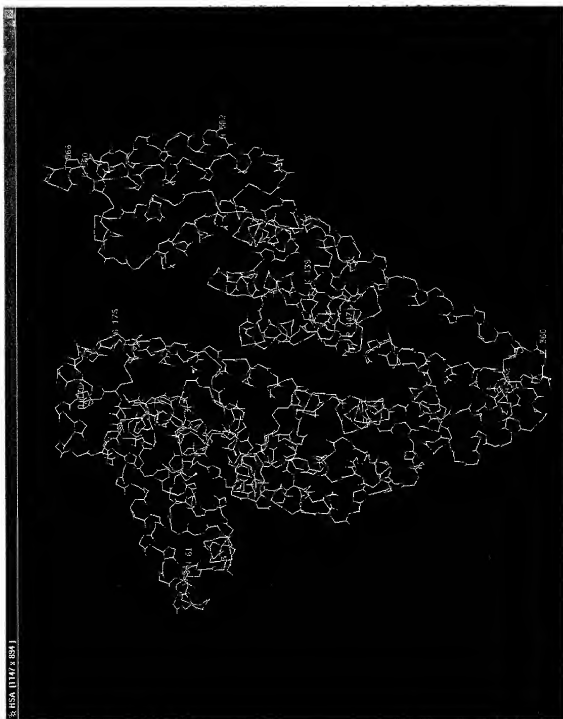




Disulfide bonds shown in yellow

Figure 12: Loop IV Gln170-Ala176

102140-81122880

**Figure 13: Tertiary Structure of HA**

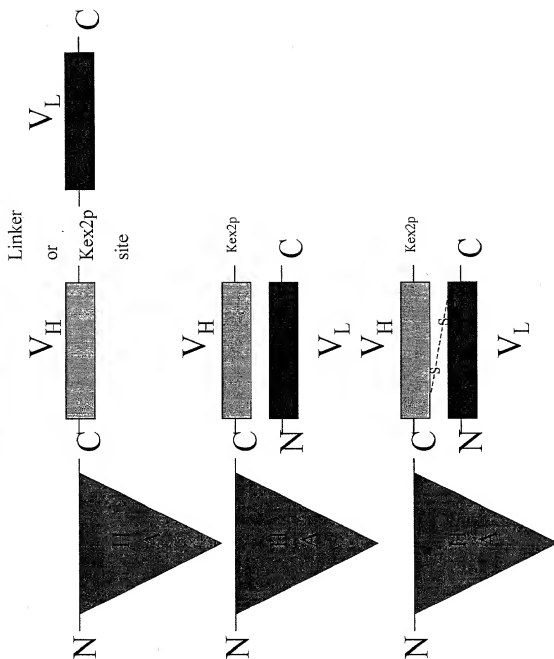


Figure 14: Schematic Diagram of Possible ScFv Fusions
 (Example is of a C-terminal fusion to HA)

15/18

1 GAT GCA CAC AAG AGT GAG GTT GCT CAT CGG TTT AAA GAT TTG GGA GAA AAT TTC AAA 60
 1 D A H K S E V A H R F K D L G E E N F K 20

61 GCC TTG GTG TTG ATT GCC TTT GCT CAG TAT CTT CAG CAG TGT CCA TTT GAA GAT CAT GTA 120
 21 A L V L I A F A Q Y L Q Q C P F E D H V 40

121 AAA TTA GTG AAT GAA GTA ACT GAA TTT GCA AAA ACA TGT GTT GCT GAT GAG TCA GCT GAA 180
 41 K L V N E V T E F A K T C V A D E S A E 60

181 AAT TGT GAC AAA TCA CTT CAT ACC CTT TTT GGA GAC AAA TTA TGC ACA GTT GCA ACT CTT 240
 61 N C D K S L H T L F G D K L C T V A T L 80

241 CGT GAA ACC TAT GGT GAA ATG GCT GAC TGC TGT GCA AAA CAA GAA CCT GAG AGA AAT GAA 300
 81 R E T Y G E M A D C C A K Q E P E R N E 100

301 TGC TTC TTG CAA CAC AAA GAT GAC AAC CCA AAC CTC CCC CGA TTG GTG AGA CCA GAG GTT 360
 101 C F L Q H K D D N P N L P R L V R P E V 120

361 GAT GTG ATG TGC ACT GCT TTT CAT GAC AAT GAA GAG ACA TTT TTG AAA AAA TAC TTA TAT 420
 121 D V M C T A F H D N E E T F L K K Y L Y 140

421 GAA ATT GCC AGA AGA CAT CCT TAC TTT TAT GCC CGG GAA CTC CTT TTC TTT GCT AAA AGG 480
 141 E I A R R H P Y F Y A P E L L F F A K R 160

Figure 15A

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481 TAT AAA GCT GCT TTT ACA GAA TGT TGC CAA GCT GCT GAT AAA GCT GCC TGC CTG TTG CCA 540
 161 Y K A A F T E C C Q A A D K A A C L L P 180

541 AAG CTC GAT GAA CTT CGG GAT GAA GGG AAG GCT TCG TCT GCC AAA CAG AGA CTC AAA TGT 600
 181 K L D E L R D E G K A S S A K Q R L K C 200

601 GCC AGT CTC CAA AAA TTT GGA GAA AGA GCT TTC AAA GCA TGG GCA GTG GCT CGC CTG AGC 660
 201 A S L Q K F G E R A F K A W A V A R L S 220

661 CAG AGA TTT CCC AAA GCT GAG TTT GCA GAA GTT TCC AAG TTA GTG ACA GAT CTT ACC AAA 720
 221 Q R F P K A E F A E V S K L V T D L T K 240

721 GTC CAC ACG GAA TGC TGC CAT GSA GAT CTG CTT GAA TGT GCT GAT GAC AGG GCG GAC CTT 780
 241 V H T E C C H G D L L E C A D D R A D L 260

781 GCC AAG TAT ATC TGT GAA AAT CAG GAT TCG ATC TCC AGT AAA CTG AAG GAA TGC TGT GAA 840
 261 A K Y I C E N Q D S I S S K L K E C C E 280

841 AAA CCT CTG TTG GAA AAA TCC CAC TGC ATT GCC GAA GTG GAA AAT GAT GAG ATG CCT GCT 900
 281 K P L L E K S H C I A E V E N D E M P A 300

901 GAC TTG CCT TCA TTA GCT GCT GAT TTT GTT GAA AGT AAG GAT GTT TGC AAA AAC TAT GCT 960
 301 D L P S L A A D F V E S K D V C K N Y A 320

Figure 15B

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961 GAG GCA AAG GAT GTC TTC CTG GGC ATG TTT TTG TAT GAA TAT GCA AGA AGG CAT CCT GAT 1020
 321 E A K D V F L G M F L Y E Y A R R H P D 340

1021 TAC TCT GTC GTG CTG CTG AGA CTT GCC AAG ACA TAT GAA ACC ACT CTA GAG AAG TGC 1080
 341 Y S V V L L L R L A K T Y E T T L E K C 360

1081 TGT GCC GCT GCA GAT CCT CAT GAA TGC TAT GCC AAA GTG TTC GAT GAA TTT AAA CCT CTT 1140
 361 C A A A D P H E C Y A K V F D E F K P L 380

1141 GTG GAA GAG CCT CAG AAT TTA ATC AAA CAA AAC TGT GAG CTT TTT GAG CAG CTT GGA GAG 1200
 381 V E E P Q N L I K Q N C E L F E Q L G E 400

1201 TAC AAA TTC CAG AAT GCG CTA TTA GTT TAC ACC AAG AAA GTA CCC CAA GTG TCA ACT 1260
 401 Y K F Q N A L L V R Y T K K V P Q V S T 420

1261 CCA ACT CTT GTA GAG GTC TCA AGA AAC CTA GGA AAA GTG GGC AOC AAA TGT TGT AAA CAT 1320
 421 P T L V E V S R N L G K V G S K C C K H 440

1321 CCT GAA GCA AAA AGA ATG CCC TGT GCA GAA GAC TAT CTA TCC GTG GTC CTG AAC CAG TTA 1380
 441 P E A K R M P C A E D Y L S V V L N Q L 460

1381 TGT GTG TTG CAT GAG AAA ACG CCA GTA AGT GAC AGA GTC ACA AAA TGC TGC ACA GAG TCC 1440
 461 C V L H E K T P V S D R V T K C C T E S 480

Figure 15C

18/18

1441 TTG CTG AAC AGG CGA CCA TGC TTT TCA GCT CTG GAA GTC GAT GAA ACA TAC GTT CCC AAA 1500
481 L V N R R P C F S A L E V D E T Y V P K 500

1501 GAG TTT AAT GCT GAA ACA TTC CAT GCA GAT ATA TGC ACA CTT TCT GAG AAG GAG 1560
501 E F N A E T F T F H A D I C T L S E K E 520

1561 AGA CAA ATC AAG AAA CAA ACT GCA CTT GTT GAG CTT GTG AAA CAC AAG CCC AAG GCA ACA 1620
521 R Q I K K Q T A L V E L V K H K P K A T 540

1621 AAA GAG CAA CTG AAA GCT GTT ATG GAT GAT TTC GCA GCT TTT GTA GAG AAG TGC TGC AAG 1680
541 K E Q L K A V M D D F A A F V E K C C K 560

1681 GCT GAC GAT AAG GAG ACC TGC TTT GCC GAG GAG GGT AAA AAA CTT GTT GCT GCA AGT CAA 1740
561 A D D K E T C F A E E G K K L V A A S Q 580

1741 GCT GCC TTA GGC TTA TAA CAT CTA CAT TTA AAA GCA TCT CAG 1782
581 A A L G L * 585

Figure 15D